
02780 – LINER FOR SEWER REHABILITATION

(Revised 11/06/06)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

[Part 1– GENERAL](#)

[Part 2 – PRODUCTS](#)

[Part 3 – EXECUTION](#)

[CIPP LINER](#)

[CIPP LINER INSTALLATION](#)

[SERVICE RECONNECTIONS](#)

[TESTING FOR ACCEPTANCE](#)

[FF LINER](#)

[FF LINER INSTALLATION](#)

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General Requirements and Supplementary Conditions applicable to this specification.
- B. Section 01000 – GENERAL REQUIREMENTS
- C. Section 02750 - SEWER LINE CLEANING
- D. Section 02760 – TELEVISION INSPECTION OF SEWER LINES
- E. Section 02770 – SEWER FLOW CONTROL

1.2 SUMMARY

This section includes sewer line rehabilitation by installation of a flexible liner system. This section includes equipment, labor, and materials necessary to perform all work for sewer line rehabilitation by cured-in-place pipe (CIPP) process or fold and form (FF) process and reconnection of service laterals.

1.3 SUBMITTALS

- A. Submit written description of procedures, equipment, and products to be used and certified copies of test reports that indicate the applicable standards have been met.
- B. Submit field information and calculations demonstrating any variance in the minimal required thickness of the liner.
- C. Submit manufacturer's certificate of compliance for all high density polyethylene material furnished in accordance with this specification section.

1.4 QUALITY ASSURANCE

- A. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.

- B. The Contractor shall comply with the latest revision of the Virginia Occupational Safety and Health Standards for the Construction Industry as adopted by the Safety and Health Codes Commission of Virginia.
- C. The Contractor shall comply with Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, "Virginia Erosion and Sedimentation Control Handbook," latest revision.
- D. The liner shall be fabricated to a size and length that, when installed, shall neatly fit the internal circumference of the sewer line section to be lined as shown on the drawings or as determined by the televised inspection. Allowance shall be given for excess pipe (rib) when the cross-sectional areas have been reduced due to offset joints, partial collapse, out of round sections, and the like.
- E. Materials and operations shall comply with the latest revision of the Codes and Standards listed below:

American Society for Testing and Materials

- | | |
|--------------------|---|
| ASTM F 1216 | Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube |
| ASTM D 790 | Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials |
| ASTM D 1248 | Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable |
| ASTM D 2837 | Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products |
| ASTM D 1693 | Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics |
| ASTM D 1784 | Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds |
| ASTM D 638 | Standard Test Method for Tensile Properties of Plastics |
| ASTM F 1533 | Standard Specification for Deformed Polyethylene (PE) Liner |

1.5 STANDARD ABBREVIATIONS

ASTM American Society For Testing and Materials

1.6 COORDINATION

- A. The contractor shall completely remove and dispose of all dirt, debris, rubbish and surplus, and unsuitable materials at the end of each work day at no additional cost to the owner.

- B. Whenever the contractor desires to use a hydrant for water supply, the contractor shall obtain the permission of the owner. All costs associated with the use of water supplied from hydrants shall not be paid for separately but shall be deemed to be included in the bid. Operation of hydrant shall be in accordance with the City Of Lynchburg Backflow Prevention Program. Use of an RPZ device or air gap is required.

PART 2- PRODUCTS

2.1 CURED-IN-PLACE LINER

- A. The cured-in-place pipe process shall consist of a flexible tube or liner that has been impregnated with a thermosetting resin, which is resistant to attack by normal components of domestic sewage. The resin shall be thermally cured to form a hard impermeable pipe, which conforms to the following minimum values when tested in accordance with ASTM F 1216.

FLEXURAL STRESS	4,500 PSI	ASTM D 790
FLEXURAL MODULUS OF ELASTICITY	250,000 PSI	ASTM D 790

- B. The liner thickness shall be based on the following physical conditions of the existing sanitary sewer pipe.
- 1) Pipes shall be subject to full soil load of 120 pounds/cf, applicable live load, and water table 5 feet below ground.
 - 2) Pipes shall be considered to have a minimum of 2 percent ovality in the circumference.
- C. Based on the above physical conditions, the liner shall have the following minimum thickness in millimeters in accordance with ASTM F 1216 unless modified by the engineer based on field information and calculations submitted by the contractor.

PIPE INVERT DEPTH

<u>NORMAL PIPE SIZE (INCHES)</u>	<u>UP TO 10 FT. (MILLIMETERS)</u>	<u>10 FT. TO 15 FT. (MILLIMETERS)</u>	<u>15 FT. AND UP (MILLIMETERS)</u>
6	4.5	4.5	4.5
8	6.0	6.0	6.0
10	6.0	6.0	7.5
12	6.0	7.5	9.0
15	7.5	9.0	10.0
18	9.0	12.0	13.5
21	10.5	13.5	15.0
24	12.0	15.0	16.5

- D. Acceptable cured-in-place process shall be "Insituform", "National liner", or "Masterliner" and shall be furnished and installed by a licensed contractor for the respective process.

2.2 FOLD AND FORM LINER

A. The sewer liner pipe and fittings shall be manufactured from the following:

- 1) High density polyethylene pipe compound which conforms to ASTM D 1248 and meets the requirements for type PE34, CLASS C product. Pipe made from this compound shall have a long-term hydrostatic strength rating of 1,600 PSI or more, in accordance with ASTM D 2837. When the environmental stress crack resistance (ESCR) of the compound is measured in accordance with ASTM D 1693, Condition C, the compound shall withstand not less than 192 hours in 100 percent solution IGEPAL CO-630 at 100 degrees F before reaching a 20 percent failure point (F20).
- 2) Polyvinyl chloride alloy pipe compound which conforms to ASTM D 1784 cell classification 12111-C, 12344-B, OR 12334-B. Pipe made from this compound shall have a long-term hydrostatic strength rating of 1,600 PSI or more, in accordance with ASTM D 2837.

B. Physical strength: The liner pipe shall conform to the minimum structural standards, as listed below:

<u>U.S. STANDARD</u>	<u>RESULTS</u>
FLEXURAL STRESS (YIELD)	ASTM D 638 3,300 PSI
FLEXURAL STRESS (BREAK)	ASTM D 638 4,500 PSI
FLEXURAL MODULUS OF ELASTICITY	ASTM D 790 145,000 PSI

- C. High density polyethylene liner material tests: Tests for compliance with this specification shall be made according to ASTM F 1533. A certificate of compliance with this specification shall be provided by the manufacturer for all high density polyethylene material furnished according to this section.
- D. The liner thickness shall be based on the following physical conditions of the existing sanitary sewer pipe.
- 1) Pipes shall be considered fully deteriorated.
 - 2) Pipes shall be subject to full soil load of 120 pounds/cf, applicable live load, and water table 5 feet below ground.
 - 3) Pipes shall be considered to have a minimum of 2 percent ovality in the circumference.
- E. Acceptable fold and form processes shall be “U-Liner Pipe”, “Nupipe”, and “Ultraliner” and shall be furnished and installed by a licensed contractor of the respective process.
- F. Seals between folded and formed liner and host pipe shall be made using a hydrophilic water sealing material such as “Hydrotite” by Greenstreak or approved equal.

PART 3- EXECUTION

3.1 GENERAL REQUIREMENTS APPLYING TO ALL REHABILITATION WORK

- A. The rehabilitation of the sewer main shall be performed without the need for excavation or demolition of existing structures, and be able to re-establish user lateral services without excavation and minimize the disruptions to neighboring homes and traffic. Excavation for point repairs or emergencies shall be permitted, but only as required and directed by the City Engineer.
- B. The finished lining shall be joint-less and continuous over the entire length of an insertion run between the starting and terminating manholes and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delaminations. If the proposed method of inserting the liner requires the modification of a manhole, the cost to modify and repair the manhole shall be performed on a force account basis and pre-approved by the City Engineer.
- C. **Pre-insertion Cleaning:** Clean the existing sewer pipe designated for rehabilitation using high-velocity water jet equipment in accordance with Section 02750- *Sewer Line Cleaning* immediately before the pre-insertion television inspection.
- D. **Pre-insertion Television Inspection:** Perform a television inspection of the designated sewer lines immediately before the rehabilitation process in accordance with Section 02760- *Television Inspection of Sewer Lines* to assure that the pipe is clean and existing pipe conditions are acceptable for lining.
- E. **Bypassing Sewage:** Provide for continuous sewage flow around the section(s) of pipe designated for the insertion of liners and service laterals connecting to these sections of pipe. The pump bypass lines shall be of adequate capacity and size to handle the flow in accordance with Section 02770- *Sewer Flow Control*.
- F. **Line Obstructions:** If pre-insertion television inspection reveals an obstruction in the existing pipe (such as heavy solids, dropped joints, protruding service taps, or collapsed pipe which will prevent completion of the lining process) that cannot be removed by conventional sewer cleaning equipment, then a point repair shall be made by the contractor at the direction of the City Engineer. Point repairs shall be performed on a force account basis and pre-approved by the City Engineer.

3.2 CURED-IN-PLACE PROCESS

- A. **Wet Out:** The contractor shall designate a location where the liner shall be impregnated (“wetted out”) with resin to thoroughly saturate the liner prior to installation. The contractor shall inform the City Construction Coordinator in advance of this operation.
- B. **Insertion:** The wetted out tube shall be transported and kept in a stable state until it is inserted through an existing manhole by approved techniques/process of the contractor. The insertion area, equipment platform, etc. shall be securely protected, and all damaged yards, driveways, walks, etc. shall be repaired, at no cost to the owner.
- C. **Curing:** After the insertion is completed, the contractor shall use a heat source to uniformly heat the liner to cure the resin in the liner. The curing temperatures shall be as recommended by the resin/catalyst system of the resin manufacturer. The

heat source shall be fitted with suitable monitors to gage the temperature of the incoming and outgoing heat source. Initial cure may be considered completed when the exposed portions of the liner appear to be hard, and the remote sensing device indicates the temperature to be adequate, as recommended by the resin/catalyst system manufacturer. Curing temperatures and duration shall comply with previously submitted data and information.

- D. **Finished Pipe:** The finished CIPP shall be continuous over the entire length from manhole to manhole and be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, pinholes, wrinkles, and other deformities. The liner passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by the City Engineer. The invert and benches shall be streamlined and improved for smooth flow. The area/annular space between existing and the CIPP shall be sealed.
- E. **Sealing and Benches in Manhole:** The CIPP shall make a tight fitting seal with the existing pipe(s) in the manhole. A ½-inch diameter activated oakum band soaked in scotch seal 5600 or equal shall be applied circumferentially near the annular space touching the end of existing pipe and encased with a cementitious mortar. Top half of the pipe shall be neatly cut off and not broken or sheared off, at least 4 inches away from the walls. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other lines or channels, if any. Channel cross-section shall be u-shaped with a minimum height of half pipe diameter, to three-fourths of the pipe diameter for 15 inches and larger. The side of the channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch towards the channel.

3.3 FOLD AND FORM PROCESS

- A. The liner shall be inserted into the existing sewer line with a power winch and steel cable connected to the end of the liner by use of an appropriate pulling head. A second pulling head may be attached to the other end of the liner for attachment of a tag line to pull the liner back out of the sewer line, if necessary. Length of the liner pipe to be inserted at any one time shall be governed by the winch drum capacity and winching power available and consideration of the size and condition of the sewer. During insertion, precautions should be taken to protect the liner pipe to prevent scoring the outside of the liner as it is being pulled into the sewer.
- B. **Reforming:** After insertion is completed, the contractor shall supply a suitable heat/pressure source and water recirculation equipment. The equipment shall be capable of delivering hot water/pressure throughout the section to uniformly raise the water temperature above the temperature required to reform the liner.
- C. The heat source shall be fitted with suitable monitors to gage the temperature of the incoming and outgoing water supply.
- D. The contractor shall cool the liner to a temperature below 100 degrees F before relieving the reforming pressure. Cool-down may be accomplished by the introduction of cool water or other approved method into the recirculation network.
- E. **Finish:** The finished liner shall be continuous over the entire length of the insertion and be as free as commercially practicable from visual defects such as foreign inclusions.

- F. **Sealing Liner at Manholes:** Seals between folded and formed liner host pipe shall be made using materials specified in Part 2 of this specification.

3.4 REINSTATEMENT OF SERVICE LATERALS

- A. **Location of Existing Service Laterals:** The exact location and number of service laterals shall be determined from television tapes and/or in the field. It shall be the contractor's responsibility to accurately field locate all existing service laterals. The contractor shall reconnect all service laterals to the liner pipe. The contractor shall restore/correct without any delay, all missed or faulty reconnections, as well as for any damage caused for not reconnecting the services soon enough. All services which are reconnected to rehabilitated liner shall be shown on the record drawings with the exact distance from the nearest upstream/downstream manhole. All existing service laterals shall be reconnected by remote television controlled cutting device method.

B. **Service Connection by Remote Cut:**

- 1) Blind attempts and/or holes in the liner are not acceptable. Location shall be re-verified carefully with earlier tapes for accuracy especially where dimples are not defined or clearly ascertained. The engineer reserves the right to require service laterals by excavation at certain locations, if the quality, workmanship, and approval rating for remote cut is poor and not satisfactory and shall be at no cost to the Owner. Excess, wrong holes or trial cuts shall not be made and shall be repaired at no cost to the owner. Defective connections shall be repaired to the Owner's satisfaction at no extra cost.
- 2) The remote cut shall be smooth and circular in nature as seen by a 360- degree television camera. The hole shall be a maximum of 100 percent and a minimum of 90 percent of the service pipe diameter. It shall be properly aligned and be concentric to the existing connection.

3.5 TESTING FOR ACCEPTANCE

Television inspection in accordance with Section 02760 – *Television Inspection of Sewer Lines* shall be provided after the liner has been installed in the existing sewer pipe. The televising shall be done after all service connections have been made. Payment for lining of sewer lines will not be made until the owner has reviewed the post-lining video tape and accepted the lining.

3.6 FAILURE OF STRUCTURAL REHABILITATION LINER

If a liner fails to reform/cure, the contractor shall be required to remove the failed liner at no additional cost. The work shall include all material, excavation, backfilling, cutting concrete, pipe shoring, temporary pavement, permanent pavement, and other incidental work required to remove the liner from the existing pipe. The City Engineer shall approve all methods to be used prior to starting work on this item.

End of Section 02780

[Back to Top](#)